LIVERMORE LAB
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory Feb. 3-7, 2014.

Photonics Online **BUILD IT AND THEY WILL COME**

The High Repetition-Rate Advanced Petawatt Laser System, or HAPLS, is being designed, developed, assembled and tested at Lawrence Livermore.

Lawrence Livermore is partnering with FEMTOLASERS Produktions GmbH (based in Vienna, Austria) as part of the construction of a revolutionary high-power laser system for the European ELI-Beamlines science facility in the Czech Republic.

LLNL is constructing the "High Repetition-Rate Advanced Petawatt Laser System" (HAPLS) for the ELI-Beamlines facility. This facility will deliver peak powers greater than one petawatt (or 1,000,000,000,000,000 watts) at a repetition rate of 10 Hz, with each pulse lasting less than 30 femtoseconds or 0.00000000000003 seconds.

In order to achieve this, the HAPLS laser requires a state-of-the-art laser "front-end" source to generate the ultrafast pulse at high stability with ultra-low noise and robust operation.

To read more, go to *Photonics Online*.

SFGate BIG TREES, BIG INFO ON BIG QUAKES

The town of Corralitos in 1887. The area was the site of several significant earthquakes, according to new research. Image courtesy of the Corralitos California History

Scientists have gathered new evidence of the powerful earthquakes that have ruptured the ground in the restless mountains near Santa Cruz by looking at fallen redwoods in the area. A new report sheds light on the seismic history of the San Andreas Fault that winds through the Santa Cruz Mountains.

Researchers from the California Geological Survey dug more than a dozen shallow trenches near the foothill village of Corralitos, to find signs of at least four of the many powerful quakes that have struck the region since Spanish colonial days.

Combining tree-ring studies and radiocarbon dating of the chips and the stumps by scientists using the Center for Accelerator Mass Spectrometry at the Lawrence Livermore National Laboratory, the researchers calculated that the chips were from trees felled by at least one woodsman working in what historical records (1830s) show was territory owned by a California settler named Don Jose Amesti.

To read more, go to the *San Francisco Chronicle*.

Lawrence Livermore is developing a new form of geothermal power that would sequester carbon dioxide and boost power generation.

A new kind of geothermal power being developed by a team of scientists from tLawrence Livermore National Laboratory could sequester carbon dioxide (CO2) while boosting power generation by at least 10 times compared to existing geothermal energy approaches.

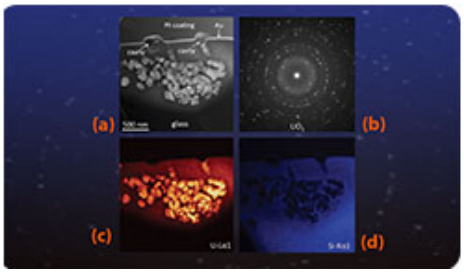
The plant design resembles "a cross between a geothermal plant and the Large Hadron Collider," featuring a network of subsurface concentric rings of horizontal wells. Inside these wells CO2, nitrogen and water circulate to draw heat from deep below ground up to the surface, where it can be used to power turbines and generate electricity.

This well arrangement encircles the injected fluids with a subsurface hydraulic dam, functioning much like a hydroelectric dam. "The intent is to recover the maximum energy benefit from fluid injection operations, a major improvement over conventional geothermal power systems," noted Tom Buscheck, an LLNL earth scientist.

To read more, go to *Power Magazine*.

PHYS.ORG

THE CHEMICAL TRAITS OF FALLOUT



The images show a technique that Lawrence Livermore scientists have developed to provide a practical approach for looking into the complex physical and chemical processes that occur during fallout formation following a nuclear detonation.

Lawrence Livermore researchers have begun to develop a technique that provides a practical approach for looking into the complex physical and chemical processes that occur during fallout formation following a nuclear detonation.

Post-detonation nuclear forensics rely on advanced analytical techniques and an understanding of the physio-chemical processes associated with a nuclear detonation to identify the device type and the source of the nuclear material in the device.

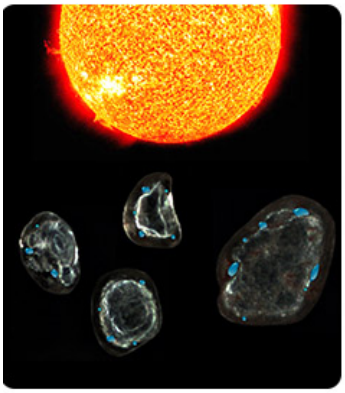
Fallout is a material formed from a cooling fireball following a detonation, in which unburned fuel, structural material and associated fission and activation products are incorporated with surrounding environmental material such as water, dust and soil.

Fallout can record chemical, physical and isotopic evidence showing the physical conditions and chemical environment associated with a detonation.

To read more, go to *Phys.org*.

ASTROBIOLOGY MAGAZINE

DUST IN THE (SOLAR) WIND



Water forms on interplanetary dust particles due to space-weathering from the solar wind. Image courtesy of John Bradley, UH SOEST/ LLNL.

For the first time, scientists have detected water molecules on the surface of interplanetary dust particles. The water forms in tiny bubbles when solar wind irradiates and damages the dust grains floating through space.

Solar wind mainly blasts clouds of hydrogen ions into space. When the wind hits cosmic debris, the ensuing damage loosens the oxygen atoms, which are then free to react with the solar wind's hydrogen, potentially resulting in the formation of tiny pockets of water. But the amount of water was too small to be detected--until now.

The research team, led by John Bradley and Hope Ishii, former Lawrence Livermore researchers and now at the University of Hawaii in Honolulu, used a state-of-the-art transmission electron microscope to finally detect these water pockets on cosmic dust.

The findings open a new possibility about the origins of life on Earth. Some theories had suggested that life was seeded on Earth by comets or asteroids bombarding the early Earth's surface, before the planet got its protective atmosphere.

To read more, go to *Astrobiology Magazine*.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance. To send input to the *Livermore Lab Report*, send e-mail